Counterbalanced orbital drive mechanism for saws and the like

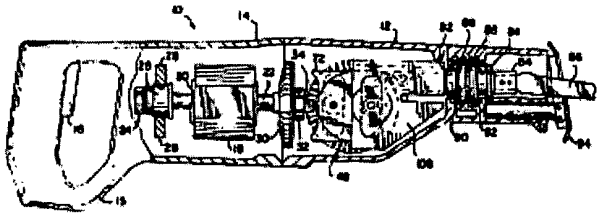
Patent number: EP0561473
Publication date: 1993-09-22
Inventor: FARMERIE JOSEPH G (US)
Applicant: SB POWER TOOL CO (US)
Classification:
- international: B23D49/16; F16F15/22
- european: B23D49/16B1, B23D51/16, F16F7/10
Application number: EP19930200782 19930317
Priority number(s): US19920853108 19920318

Also published as:
US5212887 (A1)
JP6198601 (A)
EP0561473 (B1)
CA2091807 (C)

Cited documents:
US5079844
DE3222120
US4628605

Abstract of **EP0561473**

The invention provides an orbital drive mechanism for a power operated reciprocal saw or the like which minimizes vibration to the maximum extent by the use of an oscillatory counterweight mechanism.
The drive mechanism lends itself to compact construction by having the plunger assembly (60) and the counterweight (106) move in planes parallel with the plane of rotation of the drive gear (48).



(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 561 473 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **93200782.6**

(51) Int. Cl.5: **B23D 49/16**, F16F 15/22

(22) Date of filing: **17.03.93**

(30) Priority: **18.03.92 US 853108**

(43) Date of publication of application:
22.09.93 Bulletin 93/38

(84) Designated Contracting States:
DE FR GB IT NL SE

(71) Applicant: **S-B POWER TOOL COMPANY**
4300 West Peterson Avenue
Chicago, Illinois 60646(US)

(72) Inventor: **Farmerie, Joseph G.**
17660 Lake Drive
Muskego, Wisconsin 53150(US)

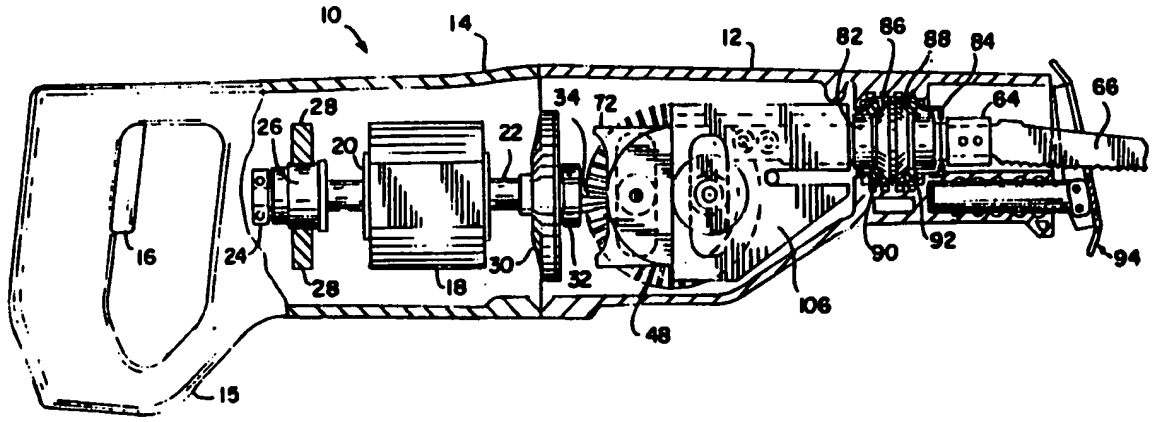
(74) Representative: **Hoorweg, Petrus Nicolaas**
OCTROOIBUREAU ARNOLD & SIEDSMA
Sweelinckplein 1
NL-2517 GK The Hague (NL)

(54) Counterbalanced orbital drive mechanism for saws and the like.

(57) The invention provides an orbital drive mechanism for a power operated reciprocal saw or the like which minimizes vibration to the maximum extent by the use of an oscillatory counterweight mechanism.

The drive mechanism lends itself to compact construction by having the plunger assembly (60) and the counterweight (106) move in planes parallel with the plane of rotation of the drive gear (48).

FIG. 1



EP 0 561 473 A1

Background Of The Invention

The present invention relates to drive mechanisms for imparting orbital movement to saw blades or the like. In particular, the present invention relates to such an orbital drive mechanism having a counterbalancing member to minimize vibration.

As is known to those skilled in the art of power tool design, it is desirable to provide reciprocating saws with an orbital movement to facilitate the cutting of materials, such as wood. Power tools of the type under consideration are referred to as recipro saws or jigsaws. As is also known to those skilled in the art, it is desirable to provide these power saws with a counterbalancing mechanism to minimize vibration.

Representative prior art is shown by United States Patents: Bauer 3,890,708; Brookfield 3,945,120; Grossmann, et al. 4,798,001; Martinez, et al. 5,009,012; Palm 5,025,562; and UK patent application 2 181 693.

Summary Of The Invention

The present invention provides a new and improved orbital drive mechanism for a power operated reciprocating saw or the like.

Another object of the present invention is the provision of an orbital drive mechanism for a power operated reciprocal saw or the like which minimizes vibration to the maximum extent by the use of an oscillatory counterweight mechanism.

Still another object of the present invention is the provision of a drive mechanism of the type described which lends itself to compact construction by having the plunger assembly and the counterweight move in planes parallel with the plane of rotation of the drive gear.

These and other objects and advantages of the invention will become apparent from the following specification disclosing a preferred embodiment.

Description Of The Drawings

FIGURE 1 is a side elevational view of a power tool embodying the present invention with a portion of the tool casing and other parts being broken away for better illustration of the orbital drive mechanism;

FIGURE 2 is a top plan view of the tool shown in Figure 1;

FIGURE 3 is a section taken along the line 3-3 of Figure 2;

FIGURE 4 is an exploded isometric view showing a part of the tool casing and the principal components of the orbital drive mechanism; and

FIGURE 5 is an enlarged exploded isometric view showing the principal parts of the orbital drive mechanism.

Description Of The Invention

Referring to the drawings, a power operated, reciprocating saw, sometimes referred to in the trade as a recipro saw, is generally designated 10. It will be understood that the present invention has applicability to other types of power tools having orbiting reciprocating cutting members, such as a jigsaw.

The power tool includes casing sections 12 and 14. The casing section 12 is preferably made in two parts, including the part 12a as shown in Figure 4. The casing section 14 includes a handle portion 15 mounting an operating trigger 16. The casing section 14 is generally hollow and receives an electric motor, such as a series or universal motor, including a stator 18 and an armature 20. The armature includes an armature or output shaft 22, one end of which is suitably mounted in a bearing assembly 24 supported by the casing 14. The armature shaft 22 includes a commutator 26 engaged by a pair of brushes 28. It will be understood that the drive mechanism of the present invention may be operated by other types of electric motors or even other types of motors, such as a pneumatic motor, for example.

The output shaft 22 has the usual cooling fan 30 mounted thereon. The other or forward end of the output shaft 22 is supported by an annular bearing assembly 32, the latter being suitably mounted in the casing section 12a. A set of beveled pinion teeth 34 is formed on the forward end of the output shaft 22.

Referring now particularly to Figure 4, it will be seen that the bearing 32 is received within annular opening 36 formed in a wall 38, the latter being integral with the housing part 12a. This same housing part includes an integral annular formation 40 which receives a dual ball bearing assembly 42. The dual ball bearing assembly 42 rotatably supports a shaft 44, the latter being suitably mounted in cantilever fashion in the formation 40 by a C-ring 46. The end 44a of the shaft 44 is suitably connected to a gear member, generally designated 48, for supporting the latter for rotation about the axis of the shaft 44.

The gear member 48 includes an annular series of beveled teeth 50; these teeth mesh with the teeth 34 on the end of the motor output shaft 22. Thus, it is apparent that the gear member 48 is driven or rotated by the motor 18.

The gear member 48 has an annular formation 52 suitably secured thereto. It is important to understand that this circular formation is eccentric

with respect to the axis of rotation of the gear member 48. Further, the gear member 48 includes a pin 54 which may be characterized as a crank pin as it is eccentric with respect to the axis of rotation of the gear. The pin 54 rotatably supports a roller 56 through a suitable bearing arrangement.

A plunger assembly is generally designated 60. This assembly includes a plunger 62 having a bracket assembly 64 at one end thereof for detachably mounting a saw blade 66 by means of fasteners 68. The other end of the plunger 62 is suitably connected to a blocklike member 70 which is connected to a plate 72 by means of fasteners 74. The plate 72 includes a rectilinear slot 76 defining opposed planar sidewalls 76a. It will be seen that the eccentrically mounted roller 56 is received within the slot 76 with diametrically opposed portions of the roller 56 respectively engaging portions of the planar surfaces 76a. The roller 56 and the slot 76 constitute, in essence, a scotch yoke assembly for imparting reciprocal movement to the plunger assembly upon rotation of the gear 48.

It will also be noted that the plate 72 includes opposed planar cam follower surfaces 78 and 80. These planar surfaces are engaged by the annular wall 52 at diametrically oppositely disposed portions on the latter. Since the annular formation 52 is eccentric with respect to the axis of rotation of the gear 48, it is apparent that oscillatory movement will be imparted to the plunger assembly 60 upon rotation of the gear 48 thereby to move the distal end portion of the blade 66 in an orbital path. This movement is orbital in nature because of the dual cam action imparted to the plunger assembly.

Referring particularly to Figures 1 and 2, it will be seen that the plunger 62 is slidably received within an annular bearing member, generally designated 82. The bearing 82 is received within an annular support 84 (Figure 1) which is suitably mounted within the tool casing 12. It will be noted that the bearing 82 has frusto-conical formations 86 and 88 which cooperate with the inner surfaces of the bracket 84 to define spaces for receiving O-rings 90 and 92. These O-rings and the clearance spaces between the bearing 82 and the inside surfaces of the bracket 84 cooperate to provide a swivel or swinging mounting for the plunger assembly thereby to permit the oscillatory movement of the latter as referred to above. It will be seen that the bearing 82 cooperates with the planar surfaces 78 and 80 to mount the plunger assembly 60 for oscillating movement in the tool casing.

It should be mentioned in passing that the power tool 10 includes and adjustable foot plate, generally designated 94. This adjustable foot plate forms no part of the present invention and thus requires no further description herein.

Referring now to Figure 5 in particular, the eccentric crank pin 54 is adapted for threading engagement with a fastener 96. The fastener 96 is connected to a disk 98 and serves to mount the latter on the gear 48 for rotation with the latter. The disk 98 defines an annular peripheral formation 100; it is important to understand that this circular formation is eccentric with respect to the axis of rotation of the gear 48. The disk 98 supports an eccentric crank pin 102 which in turn mounts a roller 104 through a suitable bearing assembly. Before describing the primary functions of the disk 98, it should be pointed out that the disk 98 holds the plunger assembly plate 72 into engagement with the annular formation 52 and the roller 56 on the gear 48.

The present invention includes a counterweight member 106 which has a mass substantially the same as the mass of the plunger assembly 60. The counterweight has a planar portion with a slot 108 defining opposed parallel planar formations 108a. It will be understood that the roller 104 is received within the slot 108 with diametrically opposed portions of the former in engagement with corresponding portions of the planar cam follower formations 108a. Thus, the roller 104 and slot 108 constitute, in effect, another scotch yoke mechanism for imparting reciprocal movement to counterweight 106 upon rotation of the gear 48.

The counterweight 106 also includes opposed parallel planar surfaces 110, 112. These planar surfaces engage the annular peripheral formation 100 of the disk 98 at diametrically opposed locations on the latter. Since the disk 98 is eccentric with respect to the axis of rotation of the gear 48, it is apparent that the disk 98 will cooperate with the scotch yoke assembly to impart oscillatory movement to the counterweight 106 upon rotation of the gear 48.

The counterweight 106 includes a further slot 114 which receives a stationary pin 116 mounted on a pedestal formation 118, the latter forming part of the casing part 12a. Thus, the slot 114 cooperates with the planar formations 108a, 110 and 112 for supporting the counterweight 106 for oscillatory movement. The counterweight is further held in place by a washer 120 having a diameter greater than the width of the slot 108. The washer is held in place by a retaining ring 122, the latter being suitably connected to the distal end of the crank pin 102. Thus, the slot 114 and pin 116 cooperate with the planar surfaces 110, 112 to mount the counterweight for oscillating movement in the tool casing. It will be apparent that this movement is essentially orbital in nature in view of the dual cam action imparted to the counterweight.

It will be noted that the crank pins 54 and 102 are in 180 degree relationship with each other. It

rotation of the gear;
(b) first and second sets of opposed cam follower formations forming part of said plunger assembly with the first set of cam follower formations being engaged by said first annular cam formation at diametrically opposed locations on the latter and with the second set of cam follower formations being engaged by said second annular cam formation at diametrically opposed locations on the latter;
(c) third and fourth different annular cam formations mounted on said gear and each being eccentric with respect to the axis of rotation of the gear;
(d) third and fourth sets of opposed cam follower formations formed on said counterweight member with the third set of cam follower formations being engaged by said third annular cam formation at diametrically opposite locations on the latter and with the fourth set of cam follower formations being engaged by said fourth annular cam formation at diametrically opposed locations on the latter;
(e) first mounting means including at least said first cam follower formation mounting said plunger assembly for orbital movement in a plane parallel with the plane of rotation of said gear; and
(f) second mounting means including at least said third cam follower formation mounting said counterweight for orbital movement in a plane parallel with the plane of rotation of said gear.

6. The power tool according to claim 5 wherein said second and fourth cam formations and the respective second and fourth cam follower formations constitute separate scotch yoke assemblies.

7. The power tool according to claim 6 wherein said first and third cam follower formations are in parallel relationship with each other and wherein said second and fourth cam follower formations are in parallel relationship with each other and in 90 degree relationship with the first and third cam follower formations.

8. The power tool according to claim 5 wherein the axis of rotation of the rotary output member is parallel with the plane of rotation of said gear.

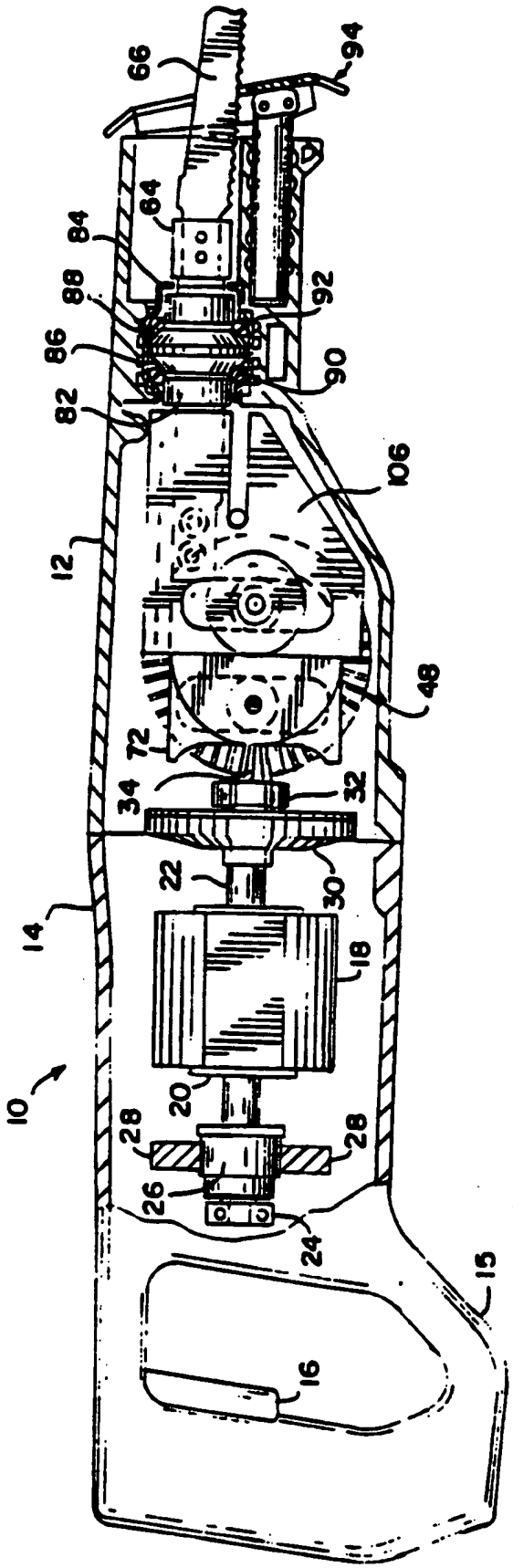

66
94
64
84
88
92
86
90
82
106
12
48
72
34
32
22
30
14
18
10
20
28
28
26
24
15
16

FIG. 1

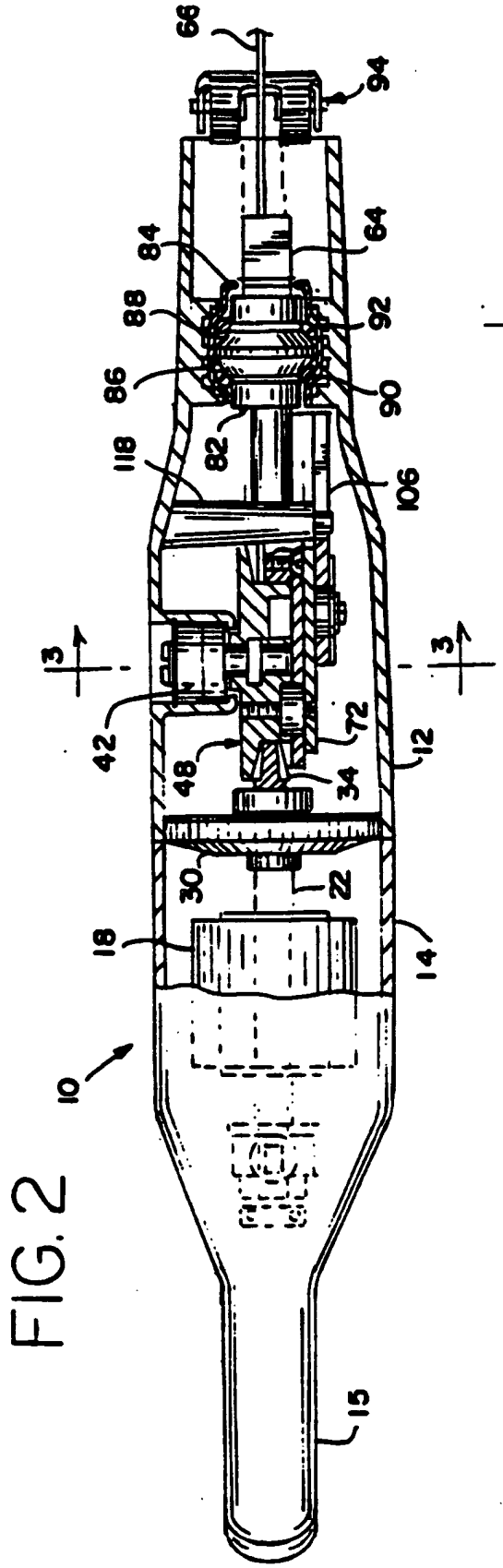

66
94
64
84
88
92
86
90
82
118
106
3
3
42
72
12
48
34
30
22
18
14
10
15

FIG. 2

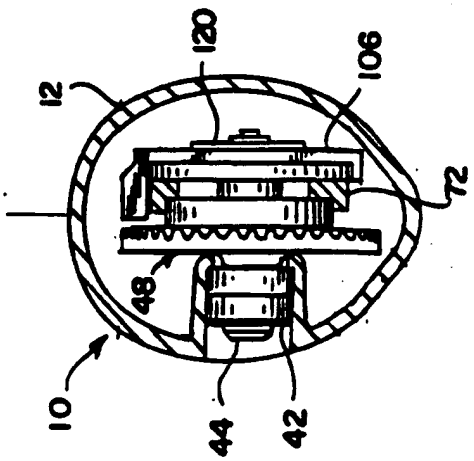

120
106
12
72
48
10
44
42

FIG. 3

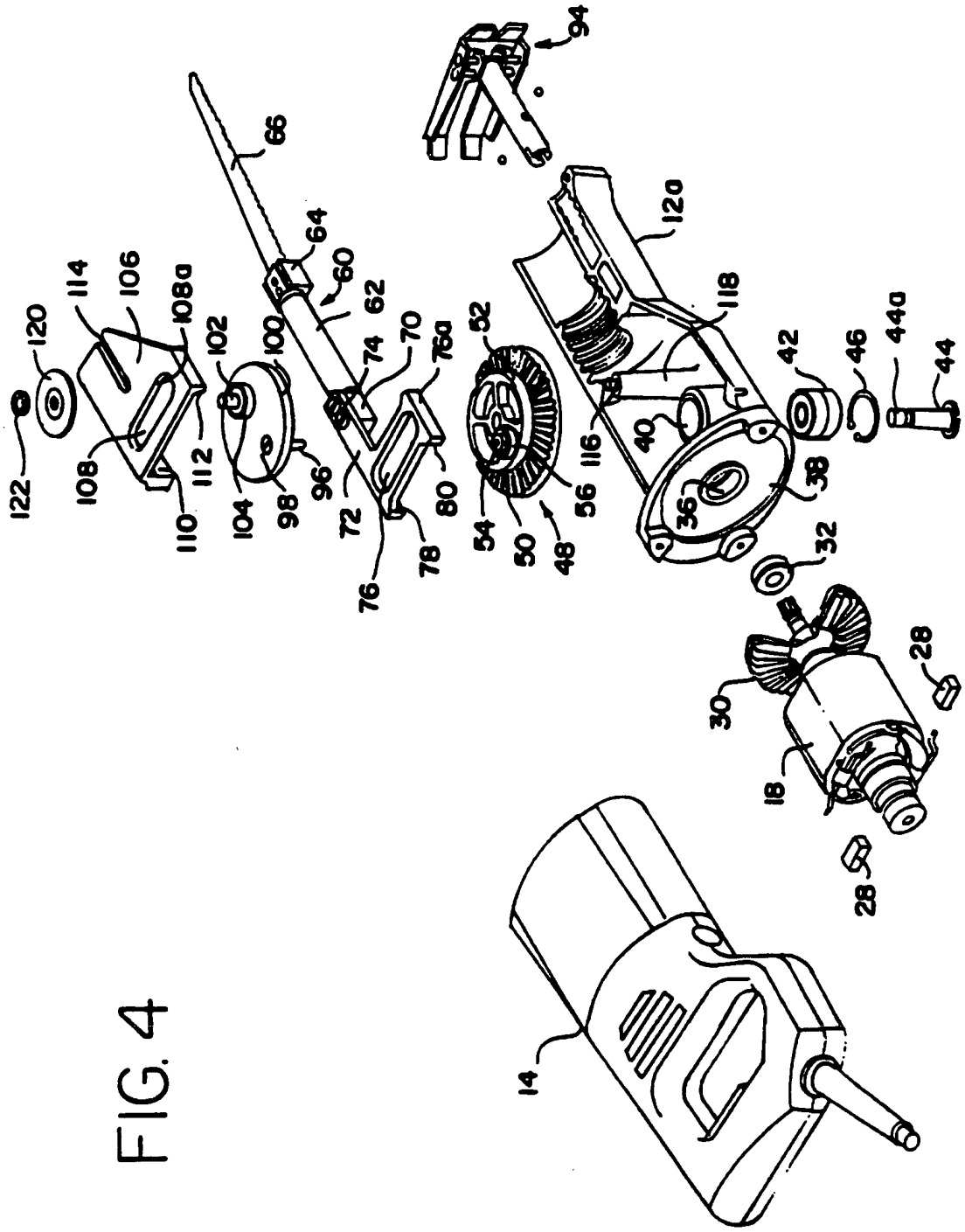
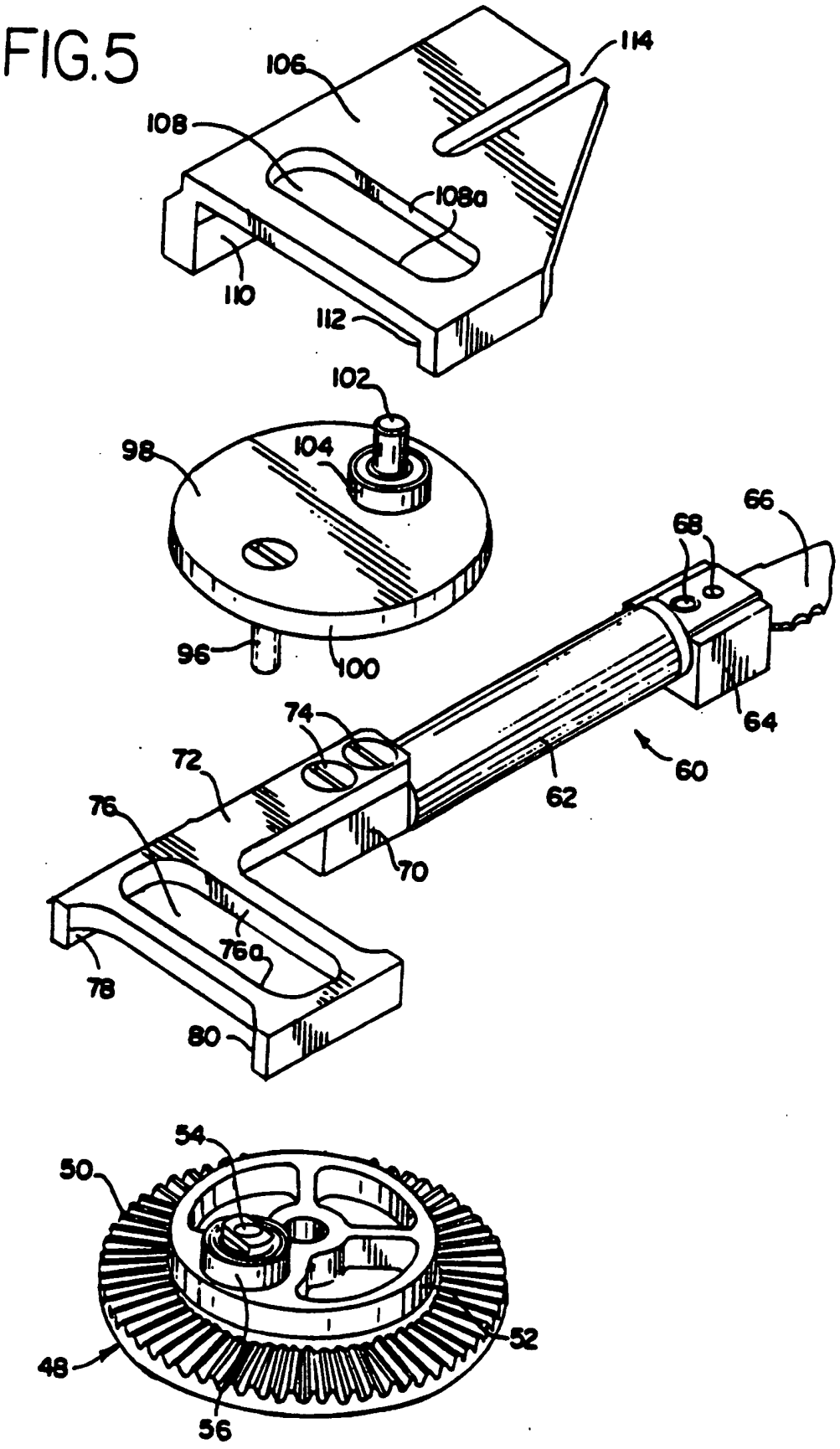

94
65
64
60
62
70
76a
74
52
120
118
42
46
44a
44
122
120
114
106
108a
102
100
108
112
110
104
98
96
72
76
78
80
54
50
48
56
116
40
36
38
32
30
28
18
28
14

FIG. 4

FIG.5


106
114
108
108a
110
112
102
104
98
66
68
96
100
64
74
72
60
62
76
70
76a
78
80
54
50
52
48
56

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 93 20 0782

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-5 079 844 (B. PALM) * column 1, line 55 - column 2, line 37 * * figures 1-4 *	1,3,4	B23D49/16 F16F15/22
A	DE-A-3 222 120 (AEG POWER TOOL CORP (APTC)) * the whole document, in particular page 11, line 24 - line 25; figures 1,2*	1,3,4	
A	US-A-4 628 605 (E.R. CLOWERS) * column 3, line 50 - line 52 * * column 6, line 4 - line 17 * * figures 2,5 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B23D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	24 JUNE 1993	MOET H.J.K.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0601)